INTEROBSERVER AGREEMENT IN THE ASSESSMENT OF LOBAR VERSUS DEEP LOCATION OF INTRACEREBRAL HAEMATOMAS ON CT

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SUMMARY

In patients with supratentorial intracerebral haemorrhage (ICH), it is important to discriminate superficial (lobar) and deep (basal ganglia) location, since this has consequences for research and prognosis. Haemorrhages at these sites have different causes and different risk factors. We studied the interobserver variation between three radiologists in classifying fifty large haematomas on CT as deep or lobar. The kappa values were almost perfect, ranging from 0.88 to 0.96. We conclude that the assessment of CT by radiologist is a reliable method to discriminate between lobar versus deep origin even for large intracerebral haematomas.

Key words: intracerebral haemorrhage, computed tomography, interobserver agreement.

INTRODUCTION

In patients with supratentorial intracerebral haemorrhage (ICH), causes, risk factors and outcome differ between superficial (lobar) and deep (basal ganglia) location [1, 9]. In epidemiological studies on risk factors of outcome and in studies on familial preponderance of ICH it is therefore important to discriminate between these two sites. Computer Tomography (CT) and in recent years Magnetic Resonance (MR) are the main diagnostic tools for identifying the location of haemorrhage. In patients with small haematomas the distinction between lobar and deep haemorrhages is often obvious, but in patients with large haematomas the origin of the haemorrhage may be obscure. In clinical practice, radiologists assess scans without a predetermined list of criteria. As this assessment is subjective, we hypothesised that interpretation of these scans varies among different radiologists. In this study we analyzed the agreement between neuroradiologists in the assessment of the localization of intracerebral haemorrhages as lobar versus deep on CT scans.
SUBJECTS AND METHODS

We used an existing database of CT scans obtained from 178 patients admitted to the University Medical Center Utrecht between January 1988 and December 1997 for supratentorial parenchymal ICH. This database did not include patients with haemorrhages on multiple locations or patients in whom the haemorrhage was caused by trauma or tumour. All CT scans were obtained within 72 hours of onset of symptoms. The volume of the haematomas was estimated with the method described by Broderick et al. [3]. Statistical calculations showed that the assessment of 50 scans from this database would provide a reliable interobserver agreement with a valid confidence interval. We selected the fifty patients with the largest haemorrhage volume, because we assumed that interobserver agreement would be worse in patients with large haematomas than in patients with small haematomas. Three radiologists with extensive experience in neuroradiology from three different Dutch hospitals independently reviewed these 50 CT scans and classified each haemorrhage as lobar or deep. A haematoma was classified as lobar if the neuroradiologists thought the origin was in one of the cerebral lobes and as deep if they thought the origin was in the basal ganglia. The neuroradiologists were unaware of clinical information at presentation and outcome at the time of the review. To quantify possible intra-observer variation, one of the radiologists evaluated 25 of the 50 scans for a second time after two months. To compare the assessment of the radiologists with the anatomical diagnosis we retrieved autopsy reports from all patients in whom a post-mortem examination was performed. For this review we used the pathological reports of the original database of 178 patients from the original database (including 3 of our 50 patients) autopsy was performed. The post-mortem reports confirmed in all cases the conclusion of the original radiologist or the three observers. In the three cases the observers failed to agree no post-mortem examination was performed.

RESULTS

The mean age of the 50 patients was 67 years (range 19 to 86); twenty-three (46%) were women. The mean haematoma volume was 95 ml (range 55 to 250), the median volume was 90 ml. Interobserver agreement was excellent between all three radiologists with a mean kappa value of 0.92, range 0.88 to 0.96 (Table I). The three radiologists came to the same conclusion in 47 of the 50 scans. The three haematomas the observers disagreed about are shown in (figure 1). Observer 1 assessed all three haemorrhages as deep, observer 2 all three as lobar and observer 3 two as deep and one as lobar. The volumes of these haemorrhages were 75 ml, 66 ml and 55 ml. There was no intra-observer variation in the 25 CT scans that were reassessed by one radiologist. These 25 scans included two of the three scans on which the three observers did not agree. In 13 of the 178 patients from the original database (including 3 of our 50 patients) autopsy was performed. The post-mortem reports confirmed in all cases the conclusion of the original radiologist or the three observers. In the three cases the observers failed to agree no post-mortem examination was performed.

DISCUSSION

Our study showed very good interobserver agreement between the neuroradiologists in the assessment of deep versus lobar origin of ICH. Although agreement in the interpretation is not the same as correctness of the interpretation, the high degree of consensus in this study is reassuring in terms of research and clinical management. The post-mortem examinations performed confirmed in all the cases the radiological diagnosis. In epidemiological research on risk factors and outcome and in studies on familial preponderance of ICH it is important to know that assessment of CT scans by radiologists is a reliable tool to discriminate between deep and lobar haemorrhages. Furthermore, accurate assessment of the origin of the haemorrhage is relevant with regard to prognosis since recent data suggest a worse long-term outcome for patients with deep haemorrhages compared with patients with lobar ICH [1]. The location of the haemorrhage may also have implications for diagnostic work-up. In young patients with spontaneous non-traumatic lobar ICH, cerebral angiography is advised to detect structural abnormalities such as vascular malformations [8, 10]. In older patients with a history of hypertension and a deep ICH the yield of angiography is much lower. Therefore, the 1999 guidelines of the American Heart Association do
not recommend angiography for older hypertensive patients with a haemorrhage in the basal ganglia, thalamus, cerebellum or brain stem in case the CT findings do not suggest a structural lesion [2, 9]. These guidelines are still in dispute, because in some studies angiography detected a structural lesion in patients not fulfilling the angiography criteria from the guidelines [6]. Diagnostic work-up is seldom indicated for patients with large haematomas, such as in our study population, because of lack of therapeutic implications.

One of the radiologists worked in an academic centre, the other two in a teaching hospital. The high degree of agreement found in our study can not be explained by bias from a similar background of the three observers, since they had been trained in three different hospitals. We therefore feel that the radiologists are a representative sample of their colleagues in referral hospitals in the Netherlands. Our results can not be generalised to local hospitals without radiologists with special interest in neurology where less agreement can be expected. Also the results can not be generalised to neurologists or neurosurgeons. Firstly because in general neurologists and neurosurgeons will have less experience in reviewing CT scans than neuroradiologists. Secondly because the observers found it a difficult task to perform, and were surprised about the high interobserver agreement attained.

We assumed that by selecting large haematomas the identification of the exact site of haemorrhage would be difficult. Surprisingly the volumes of the three haematomas for which the radiologists disagreed were all below the mean volume. Apparently medium sized haematomas are a greater challenge for radiologists than large haematomas. We have not studied patients with small haematomas, but we consider it unlikely that interobserver agreement is worse for these haematomas because such haematomas are often confined to the region of origin.

In conclusion, our findings suggest that assessment of CT by radiologists is a reliable tool for determining lobar versus deep location intracerebral haemorrhage.

REFERENCES


